HOW DOES A PRE-IPO CREDIT RATING AFFECT IPO UNDERPRICING BEFORE AND AFTER FINANCIAL CRISIS?

US EVIDENCE*

Master's Thesis
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* This Thesis is dedicated to the memory of my brother Teemu who always pushed me forward. I wish to thank my supervisor Matthijs Lof, PhD, for his valuable comments and feedback. I would like to thank also my fellow students Joakim Koene, Juho Kiiski, Riku Lehtoniemi and Roope Halonen for this journey and my wife Sari for her support.

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Abstract

This Thesis studies US IPOs with a credit rating focus. Especially I am researching IPO underpricing between two groups during 1980 and 2018: companies having a credit rating before going public and companies going public without a credit rating. I am arguing that companies having a credit rating before public listing will be underpriced less than other companies because having a credit rating before IPO corrects information asymmetries between the listing firm and an investor.

This study measures underpricing by the difference between IPO price and first day closing price. I expect that the "less underpricing" -effect of pre-IPO rated firms has faded away after the financial crisis of 2008 since the credit rating agencies played a major role in the crisis. I also argue that the Sharpe ratios are better for companies with a pre-IPO credit rating for a period after the IPO. I will start my empirical research by studying what are the characteristics for a company that does have a credit rating.

I find that companies having pre-IPO credit rating before IPO are statistically significantly less underpriced before 2008 than other companies and companies listing post-financial crisis are not underpriced less than other companies. The level of the pre-IPO credit rating does not influence IPO underprice. Over time, the volatilities are also lower among the pre-IPO rated companies but so seem the returns to be. Thus, Sharpe ratios for companies rated before listing. OLS regressions for first 30-, 60-, 120- and 365-day periods does not result any statistically significant coefficient for pre-IPO rated dummy.

Keywords IPO, IPO Underpricing, Credit rating, Credit rating agencies, Financial crisis, Pre-IPO credit rating

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Tekijä Roope Parmasuo

Työn nimi Miten luottoluokitus, joka on hankittu ennen listautumisantia, vaikuttaa listautumisen alihinnoitteluun, pitkän ajan tuottoon sekä volatiliteettiin?: Näyttöä USA:sta

Tutkinto Kauppatieteiden maisteri

Koulutusohjelma Rahoitus

Työn ohjaaja(t) Matthijs Lof

Hyväksymisvuosi 2020 **Sivumäärä** 36 **Kieli** Englanti

Tiivistelmä

Pro gradu -tutkielmassani tutkin Yhdysvalloissa tapahtuneita listautumisanteja. Olen kiinnostunut vertailemaan listautumisannin alihinnoittelua vuosien 1980 ja 2018 välillä jakaen listautumiset kahteen ryhmään: yhtiöihin, joilla on luottoluokitus ennen listautumista, sekä yhtiöihin, joilla ei ole luottoluokitusta ennen listautumista. Pyrin näyttämään toteen, että yhtiöillä, joilla on luottoluokitus ennen listautumista, ovat myös vähemmän alihinnoiteltuja kuin muut yhtiöt. Tämä johtuu siitä, että luottoluokitus korjaa epäsymmetristä informaatiota listautuvan yhtiön ja sijoittajien välillä.

Mittaan alihinnoittelua listautumishinnan ja ensimmäisen kaupankäyntipäivän päätöshinnan erotuksella. Odotan, että eroa ei synny enää vuoden 2008 finanssikriisin jälkeen johtuen luottoluokittajien suuresta roolista kriisissä. Odotan myös, että luokiteltujen listautumisten Sharpen luku on parempi listautumisen jälkeen tietyn ajan yli. Aloitan empiirisen tutkimukseni tutkimalla yhtiöiden ominaisuuksia, jotka johtavat hankkimaan luottoluokituksen.

Tulen johtopäätökseen siitä, että luokitellut listautumiset ovat tilastollisesti merkitsevästi vähemmän alihinnoiteltuja ennen vuotta 2008 kuin muut listautumiset, mutta tätä ei tapahdu enää finanssikriisin jälkeisessä ajassa. Luottoluokituksen taso ei vaikuta listautumisen alihinnoitteluun. Tuottojen volatiliteetit ovat myös alhaisemmat luokitelluissa listautumisissa ajan yli, mutta niin ovat myös tuotot. Tämä johtaa matalampiin Sharpen lukuihin näillä yhtiöillä verrattuna muihin. Pienimmän neliösumman menetelmällä mitatut listautumisen jälkeisen ensimmäisen 30, 60, 120 ja 365 päivän tuotot eivät ole tilastollisesti merkitsevästi parempia tai huonompia luokitelluilla yhtiöillä.

Avainsanat Listautumisanti, Listautumisannin alihinnoittelu, Luottoluokitus, Luottoluokituslaitos, Finanssikriisi, Listautumisantia edeltävä luottoluokitus

Contents

1 INTRODUCTION

In this Master's Thesis I study the IPO underpricing of pre-IPO credit rated firms. I find that pre-IPO rated listing firms are underpriced less than other IPOs before the financial crisis of 2008. However, after 2008 this effect seems to disappear. I argue, that the credit rating agencies were able to correct information asymmetries between the investor and listing firm before the financial crisis but due to their role during the crisis investors do not rely anymore on their opinions.

When comparing rated firms and a pre-IPO rated firms with a probit model, I also find that pre-IPO rated firms tend to be profitable and more leveraged than rated firms. The post-IPO volatilities of pre-IPO rated companies are less than the volatilities of other IPOs over time. The post-IPO returns of pre-IPO rated companies are not less or more than the returns of other listing companies.

I will first discuss some backgrounds of the current literature and findings within this area. Then, I will discuss through the data and methodology and present my hypotheses. I will also discuss through my contribution to the current academic literature. After that I will go through my results and last, I will conclude this study.

2 LITERATURE

An & Chan (2008) studied U.S. common share IPOs from 1986 to 2004 and how pre-IPO credit rating from a credit agency affects IPO pricing. They found that when the firm goes public, a company with a credit rating is underpriced significantly less than a firm without a credit rating. Credit rating level did not have a significant effect on IPO underpricing because having a credit rating corrects information asymmetry that is one of the main reasons for underpricing IPOs (An & Chan, 2008).

They find that having a credit rating of any level decreases the underpricing by 16.7-24.5% depending on estimation procedure. These results are statistically significant at the 5% level. According to their findings, an average company with a pre-IPO credit rating is relatively large (measured by logarithm of sales) and also older than 5 years prior the IPO. In addition, firms, which operates in an industry with a usual high Altman's Z-score, and also firms with high Altman's Z-score, are more likely to have credit ratings than other firms (An & Chan, 2008).

My thesis will relate mostly to the study that An and Chan made in 2008. I am seeking to develop their findings but also contribute to the literature with new data after the financial crisis of 2008. This allow us to see how An and Chan's findings have developed and how the trust to credit rating agencies has evolved after the crisis.

2.1 IPO Underpricing

When company does want to raise equity by initial public offering (IPO) the company sells its own stocks in a public market. However, the IPO tends to be underpriced which results usually a significant "price jump" on the first day of trading. Ritter (2018) calculates that the underpricing discount was 14.8% (equal-weighted) by average in IPOs in the United States during 1990s and during the years of 2000 and 2017 the equal-weighted average in IPO underpricing has been 13.9%. This large underprice results to a significant amount of money left on the table: over $58 billion in the years of 2000-2017 (Ritter 2018). During the dot-com crisis (1999-2000) the average underprice was 64.6%, which resulted leaving over $66 billion on the table. Ljungqvist (2005) studies four different reasons that could be behind this phenomenon:

1. Asymmetric information
2. Institutional reasons
3. The control of shareholders
4. Behavioral reasons

Asymmetric information, which I will also focus mostly on this Thesis, argues that one of the IPO parties (issuing firm, underwriter and new investors) know more than the other parties do. Thus, to correct this distrust among the parties, the sell-side parties must give investors a discount. Investors would not pay the full price for the equity. Rock (1986) introduced one of the most known asymmetric information models, winner's curse. According to his model, there are two types of investors: informed and uninformed. The informed investors would only bid for well-priced IPOs while the uninformed investors bid randomly. This would lead to a situation where uninformed investors would get all the shares in overpriced IPOs they bid for and only a part of their bid in underpriced IPOs. This would lead to negative returns for uninformed investors and they would then stop bidding in IPOs. Rock argues that there would be then a loss of investors in the IPO market and demand side would shrink. Thus, IPOs should be underpriced so that the uninformed investors would at least break-even.

Institutional reasons are associated with litigation, banks' inner systems to stabilize the equity price and taxes. Litigiousness means that companies sells their stock at a discount because they are afraid that disappointed shareholders would sue the company for poor post-IPO performance. This argument is quite US based. Price stabilization systems relates to the service that underwriter usually also offers: the underwriter promises to "manipulate" the share price after IPO for few days or weeks so that the price would not drop significantly. These is a reason why the IPO would be underpriced so that the underwriter would not have to use its tools to "correct" the market price of the share so aggressively. Thirdly, some parties might have tax advantages in IPOs. Taranto (2003) shows that companies, which rely on stock options in rewarding management and employees, IPOs are more underpriced. Thus, the management and employees would not have to pay as much taxes while executing their options. Stock options are preferred usually if capital income is taxed lighter than employment income.

Control theories suggest that companies offering equity wants as large shareholder base as possible so that one shareholder could not take too much power in the company. There are two principal theories, which are opposite. Both theories approach ownership issue through agency problems. When ownership and control is separated it can cause issues for managers what to maximize: their private benefits or shareholders' value. Brennan and Franks (1997) believes that underpricing happens so the firm will attract large investor base and thus avoid monitoring. Stoughton and Zechner (1998) suggests that underpricing minimizes agency costs and thus encourages investors to monitor. They hypotheses that large institutions are the only investor-type that have possibility to monitor the management while small shareholders "free-ride" with them (Stoughton & Zechner, 1998).
Behavioral theories argue that there are irrational investors in the market who bid under the true value. This literature is, however, narrow (Ljunqgvist 2005).

2.2 Credit rating agencies

"Any user of the information contained herein should not rely on any credit rating or other opinion contained herein in making any investment decision."

-Standard & Poor's standard disclaimer at the bottom of its credit ratings

The main concern for a lender (and investor in bonds), is whether the borrower can repay the loan. The lender collects information about the borrower and based on the information she has

collected, make a proposition about the terms of a loan. However, a lender might also be interested in an objective and outside opinion about borrower's creditworthiness. This is where credit rating agencies steps in: to clean the information asymmetries between the lender and the borrower (White 2010).

The first publicly available bond ratings were published by John Moody in the 1909. The ratings focused solely on railroad bonds. John Moody was followed by Poor's Publishing Company in 1916, Standard Statistics Company in 1922 and Fitch Publishing Company in 1924. After many mergers, spin offs and acquisitions, we are left nowadays with the notable "Big Three" credit rating agencies: Moody's, Standard & Poor's (S&P) and Fitch. Credit rating agencies gives their "opinion" about the credit quality of a company, country or a certain security. The opinion is given in a letter grade, ranging from AAA to D as following: AAA, AA, A, BBB, BB, etc. The letter also can contain "+" or "-" to adjust the rating more accurate. BBB- is the last rating in so called "investment grade" class. Lower than that is called "non-investment grade", also known as "high-yield bonds" or "junk bonds".

The business boomed in the 1930s when US bank regulators encouraged banks to invest only in safe bonds rather than "speculative investment securities", nowadays junk bonds. US regulators forced the banks to use opinions from the publishers of "recognized rating manuals". The only four possible options to choose from were Moody's, Poor's, Standard and Fitch. The Securities and Exchange Commission (SEC) later made these players' market positions even stronger and the barriers to entry were large (White 2010).

In the 1970s the large rating agencies changed their business model: John Moody's presented "investor pays" model now converted to "issuer pays". This new business model now could arise to conflicts of interest: Skreta and Veldkamp (2009) argues that "rating shopping" could happen, especially in more complex securities: If a borrower has option to choose from more than one opinion about its creditworthiness, the borrower would then choose the most optimistic one. However, Smith and Walter (2002) argues that the agency issues were not a problem first. This was due to the simple ratings in simple products: Usually a corporation or government issued a "plain vanilla" debt and the process was rather transparent.

After the bankruptcy of Enron in the end of 2001 and bankruptcy of WorldCom in 2002 the three agencies were asked, how the bonds of these both companies were graded to investment

grade just until the bankruptcies. In addition, Lehman Brothers was also rated as an investment grade corporation the same day they filed for bankruptcy (White, 2010). The rating agencies replied for the critic that their goal is to provide long-term ratings, rather than constantly updating ratings. The demand side of credit ratings generates a paradox: in other hand they would like to have current and updated ratings but in other hand the investors do not want to balance their portfolios the whole time because it is costly (Altman & Rijken, 2004) and investors would not value ratings which just follows market prices. (Fons et al., 2002).

The "issuer pays" business model has been criticized to be a key reason also for the overoptimistic credit ratings during subprime crisis. In addition, Mason and Rosner (2007) reports about a clear difference between rating process of a bond and, say, a collateralized debt obligation (CDO): The credit rating agencies were consulted by the issuers of the securities on building the security instrument. This led to a situation where issuer knew what to pack to a security so that it will earn a good credit rating and thus will be easily sold to issuer's customers. (Mason & Rosner, 2007). The issuers had also great bargaining power: If an issuer was not pleased with the ratings there was a threat that the issuer moved all its security business to another credit rating agency. Adding all these aspects together as well that fact that the new CDO securities were really complex, credit ratings for these securities were usually highly overoptimistic. Financial Crisis Inquiry Commission of The United States (2010) wrote in *"The Financial Crisis Inquiry Report"* reported that $300 billion CDOs issued in 2005-2007 (which represents over half of the total value issued during that period) with a AAA –rating were downgraded to "junk" by the end of 2009.

Because of the changes in business model and the problems during the financial crisis, I argue that the investors trust towards credit rating agencies might have decreased after the financial crisis. This helps me to construct my Hypothesis 2 that I discuss later.

"Credit rating agencies assigned overly optimistic ratings to the CDOs built from mortgage-backed securities. By erroneously rating these bundles of mortgage-backed security payments too highly, the credit rating agencies substantially contributed to the creation of toxic financial assets."

-Financial Crisis Inquiry Commission, 2010

3 DATA AND METHODS

3.1 Data

My sample consists of primary IPOs from 1980 to 2018 from the US. The IPOs and the listing prices are collected from SDC Platinum by Thomson Financial Securities Data. I have excluded American depositary receipts (ADRs), closed-end funds, financial institutions (SIC codes 6000-6999) and real estate investment trusts.

I collected the credit rating data and the IPO dates from Compustat (Standard & Poor's Long-Term Domestic Issuer Credit Rating). According to Compustat, this data item is *a current opinion of an issuer's overall creditworthiness, apart from its ability to repay individual obligations. This opinion focuses on the obligor's capacity and willingness to meet its long-term financial commitments (those with maturities of more than one year) as they come due*. Also accounting measurements (total assets, debt in current liabilities, long-term debt, intangible assets, total liabilities, total PPE, retained earnings, working capital, EBIT, EBITDA, revenue and stockholder's equity) are collected from Compustat. I collected the daily stock price data for my sample from CRSP using 6-digit CUSIP codes. The data of CRSP, Compustat and SDC Platinum is all linked by CUSIP. This caused some errors and data losses but in the end of linking I am left with sample of 4,294 IPOS and 206 of them having credit rating before IPO. The accurate definitions of the Table 1 below are described in section 6.3. Control variables.

Table 1. Descriptive statistics.

Statistic	N	Mean	St. Dev.	Min	Pctl (25)	Pctl (75)	Max
CREDIT	4,294	0.05	0.22	0	0	0	1
LOGSALES	2,019	3.33	2.20	-6.91	2.18	4.76	9.97
PROFITABLE	1,952	-4.74	52.33	-1,465	0.00	0.18	1
LEVERAGE	2,360	0.44	2.30	0	0.04	0.53	103.60
PPE/TOTAL ASSETS	2,317	0.25	0.25	0	0.06	0.36	1
ALTMANZ	1,528	1.70	3.01	-3.20	1.22	5.32	11.45

Table 1. This table shows the descriptive statistics for the variables I am using in this study. The names of a statistic are explained in the Table 2.

Figure 1. IPOs in my sample.

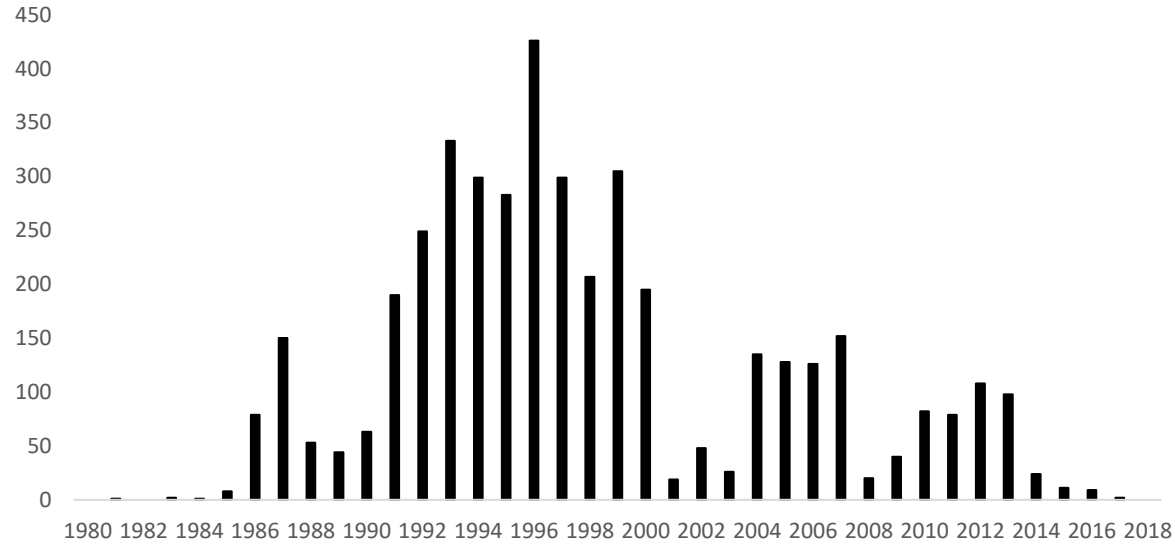

Figure 1. IPOs in total, listed in North America stock exchanges during 1980-2018. Source: SDC Platinum.

Figure 1 shows the deviation of my sample from year to year. The spike in IPOs happens before the Dot-com bubble in 2000.

Figure 2. Pre-IPO credit rated listing firms.

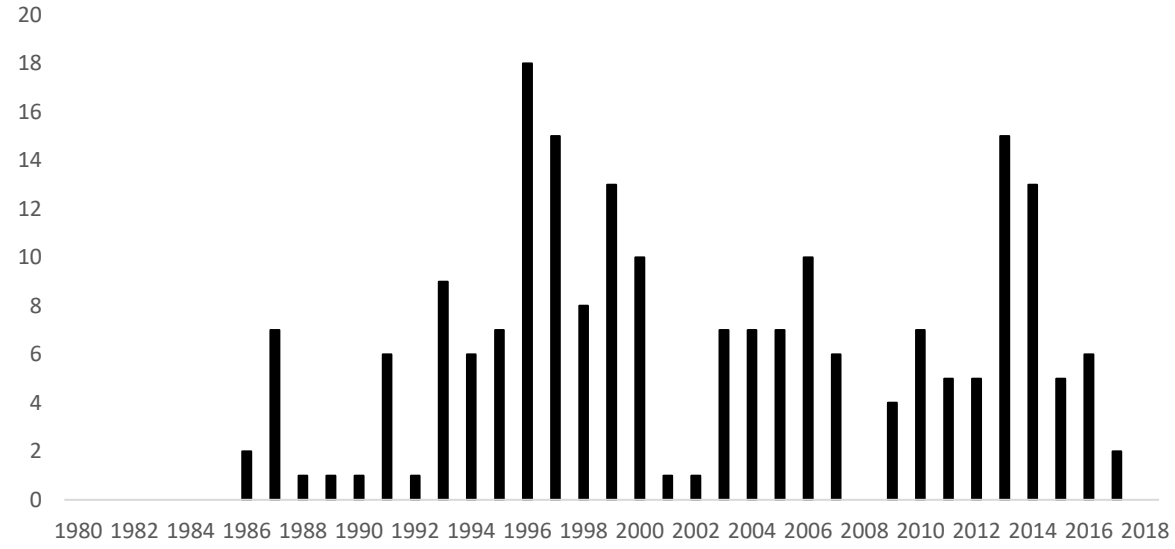

Figure 2. IPOs with a credit rating before going public. North America stock exchanges, 1980-2018 Source: Compustat.

Figure 2 shows the deviation of IPOs with a pre-IPO credit rating. The figure follows Figure 1 and gives me the opportunity to study my research questions well.

3.2 Methodology

3.2.1 Credit rating existence and effect

Like An & Chan (2008) I will first study what kind of company has a credit rating with a probit model and then I will study how having a credit rating affects IPO underprice with OLS. I will examine the effect of having a pre-IPO credit rating with the following OLS regression model

$$Y_i = \alpha + \beta_i \cdot X_i + \gamma_i \cdot CRD_i + \varepsilon_i$$

, where Y_i is IPO underpricing (%-change of first trading day closing price – issue price), X_i is a set of explanatory variables (firm's size, profitability and growth and quality measurements) and β_i is the estimator, CRD_i is a dummy that equals to 1 if company has a credit rating and γ_i is the parameter for measuring the effect of having a pre-IPO credit rating to IPO pricing.

3.2.2 Long-term return and volatility

I will calculate volatilities for both stocks with pre-IPO credit rating and stocks without it for next 30, 60, 120 and 365 days after the issue. I will also compare 30, 60, 120 and 365 returns for the same stock baskets. After all, I am available to calculate Sharpe ratios for both types of stocks and compare the performance between these groups. I will calculate mean for different periods and discuss about the differences between the two groups.

In addition, I will regress the returns of different periods using Fama-French five-factor and momentum factor (Fama-French 1993) and see are there any statistical differences between these two group in terms of performing. Fama-French five-factor model is described as follows

$$R_i - R_f = \beta_{R_M}(R_M - R_F) + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{RMW}RMW + \beta_{CMA}CMA + \varepsilon_i$$

, where $R_i - R_f$ is the excess return of a stock or portfolio, $R_M - R_F$ is the excess return of market portfolio, SMB stands for market capitalization factor (Small Minus Big), HML is the

book-to-market ratio (High Minus Low). The formula until this is known as Fama-French three-factor model. When we add RMW (profitability factor, Robust Minus Weak) and CMA (investment factor, Conservative Minus Aggressive). In addition, I will add the momentum factor presented by Carhart (1997). Momentum factor (in the following Sections MOM) is a factor to capture the return of prior-month winners minus prior-month losers.

3.2.3 Control variables

Faulkender and Petersen (2006) and Liu and Malatesta (2006) results that a firm is more likely to have a credit rating when it is larger, older, more profitable, has more tangible assets, and less growth opportunities. I will control these things among other variables. See the following Table 2 for explanations of used control variables.

Table 2. Control variables used in regressions

CREDIT	*Dummy: 1, if IPO has credit rating, 0 if not*
LOGSALES	*Logarithm of Sales*
PROFITABLE	*EBITDA divided by Sales*
CRLEVEL	*Dummy which indicates the level of credit rating*
IPOYEAR	*Dummy which controls the time when the IPO occurs*
LEVERAGE	*Total Debt/Total assets*
PPE/TOTAL ASSETS	*Controls tangibility of the company*
ALTMANZ	*Altman Z for private firms*
$R_m - R_f$	*The excess return of the market portfolio*
R_f	*Risk-free rate*
SMB	*Fama & French Small Minus Big factor*
HML	*Fama & French High Minus Low factor*
RMW	*Fama & French Robust Minus Weak factor*
CMA	*Conservative Minus Aggressive factor*
MOM	*Fama & French Momentum factor*

Table 2. Control variables explained.

CREDIT dummy indicates whether a company has a pre-IPO credit rating (1) or not (0). LOGSALES will indicate the logarithm of sales. PROFITABLE indicates the profitability of the company and is calculated as EBITDA divided by sales. CRLEVEL controls the level of firm's credit rating if it has one prior IPO. IPOYEAR controls the time: I will use it as a dummy for all years and also as binary dummy to indicate the financial crisis of 2008. LEVERAGE is calculated by Total Debt / Total Assets. PPE/TOTAL ASSETS indicates the tangibility of the company by dividing firm's property, plants and equipment by total assets.

ALTMANZ is calculated as follows:

$$Z = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$$

, where X_1 is working capital divided by total assets, X_2 is retained earnings divided by total assets, X_3 is EBIT divided by total assets, X_4 is book value of equity divided by total liabilities and X_5 is sales divided by total assets. If $Z > 2.9$ the company is in so called "Safe zone" from bankruptcy the next two years. If the Z-Score is $1.23 < Z < 2.99$ the company is in the "Grey zone". If $Z < 1.23$ the company is in "Distress zone" (Altman 2000).

3.3 Contribution

I will follow the study by An & Chan (2008) and add OLS as a new method to model the IPO underpricing. I will also study pre- and post-financial crisis periods separately. The change of underpricing within pre-IPO rated companies around the financial crisis is my key-contribution and key-finding of this study: pre-IPO rated companies are not underpriced after 2008 like they were before the financial crisis year. I will also study long-term returns and volatilities after the IPO and calculate Sharpe ratios for different periods and find that the volatilities seem to be less among the pre-IPO rated firms compared to other firms.

All in all, my Thesis enlightens the investors' trust towards credit rating agencies that rates firms. Credit rating agencies played huge role rating the derivatives during the crisis that can be seen as a crucial player that caused the crisis to trigger.

I hope that my study will also arouse interest in this topic: one could study the trust to credit rating agencies different ways and with different data. For example, I suggest that one could ask different types of investors their opinion towards credit rating agencies and find supportive evidence to my hypotheses.

3.4 Limitations

There are some problems and limitations considering IPOs when comparing them. My study will face the same limitations and problems as other literature: I will not be able to use perfect control variables and need to follow current literature in using proxies in some control variables. Also, the data quality is in some cases for some period poor and combining the data sets from

different sources will cause some missing data. For example, the CUSIPs between SDC Platinum and Compustat & CRSP had some unexcepted differences that I was able to mostly tackle. Still, this caused some data losing.

The quality of financial data of Compustat was the most lacking data. Since I am studying IPOs and I need figures from the year of IPO or even prior the IPO these figures were somewhat hard to acquire. This results as a smaller sample size that can be seen especially in certain subsample regressions. This links to one key-limitation in my study: Especially after the year 2008 the volume of IPOs with a pre-IPO credit rating and complete financial data is so far rather small.

3.5 Testable Hypotheses

My hypotheses can be separated to two different focused parts: *H1* and *H2* will focus solely on stock metrics (underprice in IPO, long-term returns and volatility). *H3* will focus to study the trustworthiness of credit rating agencies and I will try to explain that through my core study (*H1* and *H2*).

> *H1: Companies with any level of a credit rating are less underpriced in IPOs than companies without a credit rating.*

This is because credit rating decreases the amount of uncertainty and information asymmetry, just having a credit rating (any level) is sufficient. Since credit rating agencies should provide and independent evaluation of a company's risk profile, I argue that this will be seen also in IPO process. As An and Chan (2008) argue, I am also arguing that the credit rating level does not have an effect on the IPO pricing. Since the credit rating has been assigned, no matter the level of it, it has the same value in correcting information asymmetries.

> *H2: The underpricing effect in IPOs with pre-IPO credit rating has declined after the 2008 financial crisis due to credit rating agencies' lost reputation:*

I argue that after the financial crisis of 2008 where the credit rating agencies played also a prominent role, investors do not rely on credit ratings anymore as significantly as before this period. I will discuss this through with an example from Moody's in Section 7.2.2. Financial crisis.

H3: Companies with a pre-IPO credit rating have lower volatilities after the IPO compared to other companies. This means less uncertainty in the returns and thus lower expected returns.

My last Hypothesis has been developed from An & Chan's (2008) hypothesis: *Other things being equal, aftermarket volatility of IPO stocks with credit ratings is significantly less than that of IPOs without ratings.* I will also study the volatilities but also look up into the returns and measure stock performance after the IPO with Sharpe ratio that is defined in Section 7.2.5. Returns and volatilities. This way I am able to study if the pre-IPO rated companies perform better over time after IPO in terms of returns and volatility relation.

4 RESULTS

4.1 The probability of a company having a credit rating

Before getting into the questions of my hypotheses, in this section I will estimate the probability of a company having a rating in general using a probit model. For a clarification, I will estimate the probability of having a rating at all, before or after ones IPO. The model as follows

$$\Pr(Y = 1|X)$$

, where conditional probability is studied for Y (the dependent variable that can only get two value, in this case has credit rating (1) or has not credit rating (0)) with X conditions. This helps to understand the reasons behind having a credit rating and the reasons behind it. This helps to have a comprehensive understanding for the topic of my Thesis. I will first run a probit model for the probability of having a credit rating at all and then run the same model for the probability of having a pre-IPO credit rating.

Table 3. Probability of having a credit rating.

	Dependent variable:	
	Credit rating	
	(1)	(2)
PROFITABLE	-0.002**	-0.002**
	(0.001)	(0.001)
LOGSALES	0.360***	0.333***
	(0.030)	(0.024)
LEVERAGE	0.098**	0.099**
	(0.042)	(0.040)
PPE/TOTAL ASSETS	1.139***	1.017***
	(0.202)	(0.157)
ALTMANZ	0.00001	
	(0.0001)	
Constant	-3.045***	-2.840***
	(0.165)	(0.131)
Observations	1,499	1,953
Log Likelihood	-439.534	-607.021
Akaike Inf. Crit.	891.068	1,224.042
Note:	*p<0.1; **p<0.05; ***p<0.01	

Table 3. Probit model for estimating the probability of a company having a credit rating. Standard errors are in brackets under coefficient estimates and statistical significance is reported with *, ** and *** to sign statistical significance at 10%, 5% and 1% levels respectively.

As one can see on the Table 3, the probability of having a credit rating is explained significantly by the amount of sales, leverage and tangible assets. In addition, profitability seems to have a negative coefficient. These findings are in line with the current literature: An & Chan (2008) also finds that the size and leverage have a positive effect on the probability of having a credit rating. This is also intuitive: the bigger and more leveraged the company is, the larger are e.g. the needs in financing and thus a credit rating from a credit rating agency can help them to fix asymmetric information problems among investors and lenders (see also Faulkender and Petersen, 2006).

Large firms do have also the resource to acquire credit rating easier. Also, companies having a lot of tangible assets (high PPE/TOTAL ASSETS) can be seen easier to acquire loan since they can use their assets as a collateral. Denis and Mihov (2003) argues also that the current level of high leverage can be seen as a sign of good reputation in the financial markets and these

companies are more likely to issue bonds or another type of public debt (Denis and Mihov, 2003).

In addition to this, I wanted to see if there are differences between the results above and running a probit model to test the probability of a company having a pre-IPO credit rating. These results can be seen in the Table 4 below.

Table 4. Probability of having a pre-IPO credit rating.

	Dependent variable:
	Pre-IPO credit rating
PROFITABLE	0.909***
	(0.148)
LOGSALES	0.230***
	(0.054)
LEVERAGE	1.303***
	(0.197)
PPE/TOTAL ASSETS	0.100
	(0.390)
ALTMANZ	0.0001
	(0.0004)
Constant	-3.970***
	(0.392)
Observations	3,659
Log Likelihood	-320.733
Akaike Inf. Crit.	653.467
Note:	*p<0.1; **p<0.05; ***p<0.01

Table 4. Probit model for estimating the probability of a company having a pre-IPO credit rating. Standard errors are in brackets under coefficient estimates and statistical significance is reported with *, ** and *** to sign statistical significance at 10%, 5% and 1% levels respectively.

An & Chan (2008) has not reported if they studied this but the results differ from the results in the Table 4: Companies having a pre-IPO credit rating are actually profitable and more levered. I argue that the companies that are profitable have more possibilities to loan money. And when you are more levered this means that a credit rating might be needed after some limit or at least it eases a company's possibilities of getting more loan.

4.2 IPO underpricing

4.2.1 IPO underpricing using the whole sample

In this section I will now study my *H1* and *H2*. I will first start using the whole sample and will also perform robustness checks with subsets of data. Then I will be focusing on *H2*, the pre- and post-era of the financial crisis of 2008.

Table 5. Return of IPO using the whole sample.

	Dependent variable:			
	IPO return: %-change of closing price – issue price			
	(1)	(2)	(3)	(4)
CREDIT	-0.102*	-0.015	-0.126**	-0.080
	(0.053)	(0.055)	(0.051)	(0.053)
PROFITABLE		0.0004**		0.0004**
		(0.0002)		(0.0002)
LOGSALES		-0.029***		-0.017***
		(0.006)		(0.006)
LEVERAGE		-0.008		-0.022*
		(0.013)		(0.012)
PPE/TOTAL ASSETS		-0.152***		-0.102**
		(0.053)		(0.050)
ALTMANZ		-0.00000		-0.00000
		(0.00004)		(0.00004)
Constant	0.204***	0.344***		
	(0.012)	(0.026)		
Fixed effects?	No	No	Yes	Yes
Observations	1,474	1,474	1,474	1,474
R^2	0.003	0.027	0.163	0.174
Adjusted R^2	0.002	0.023	0.142	0.151
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 5. Regression results for the whole sample (1980-2018) using OLS with and without yearly fixed effects. Standard errors are in brackets under coefficient estimates and statistical significance is reported with *, ** and *** to sign statistical significance at 10%, 5% and 1% levels respectively.

While performing the regressions using OLS, my results differ from An & Chan's (2008) results. Using available control variables, having a pre-IPO credit rating do not indicate less underpricing at IPOs. Other valuable mention from the Table 5 is that it seems that the larger the sales of the listing company, the smaller are the IPO returns. This is in line with the current

literature: for example, Lizinska and Czapiewski (2004) argues that smaller pre-IPO companies tend to be underpriced more than large companies. Also, companies having more tangible assets are underpriced less. This finding is intuitive: companies having large amount of tangible assets in their balance sheet are doing business with machines, lands and other real estates and can be seen as more conservative companies. Vice versa, companies having more intangible assets can be seen as high-tech companies that tends to perform better in IPOs.

These results now indicate that I need to reject my *H1* and the results are not in line with current literature.

4.2.2 Financial crisis

Next I will divide the sample to pre-2008 and post-2008 period and then discuss about *H2*. I have divided the sample in two parts: IPOs before 31st December 2007 and IPOs after 1st January 2009. This way I will exclude the whole year of 2008 from my sample. These cut offs can be seen rather conservative. Lehman Brothers filed on 15th September 2008 for Chapter 11 bankruptcy protection. Below we can see the actions for Lehman Brothers in 2008 of one credit rating agency, Moody's:

Table 6. Moody's & Lehman Brothers.

Date	Action	Title
08 Dec 2008	Rating Action	Moody's lowers ratings of Lehman Brothers; will withdraw ratings
15 Sep 2008	Rating Action	Moody's lowers Lehman to B3/Non-Prime; on review for possible further downgrade
10 Sep 2008	Rating Action	Moody's places Lehman's A2 rating on review with direction uncertain
09 Sep 2008	Announcement	Moody's comments on Lehman Brothers
17 Jul 2008	Rating Action	Moody's lowers Lehman Brothers rating to A2; outlook negative
13 Jun 2008	Rating Action	Moody's places Lehman's A1 rating on review for downgrade; Prime-1 affirmed
09 Jun 2008	Rating Action	Moody's changes Lehman's rating outlook to negative
15 Apr 2008	Liquidity Risk Assessment	Lehman Brothers, Inc.
17 Mar 2008	Rating Action	Moody's affirms Lehman's A1 rating; outlook now stable

Table 6. The actions of Moody's for Lehman Brothers during 2008. Source: Moody's

As seen from the Table 6, on 10th September 2008 Moody's confirms the credit rating of Lehman Brothers to be A2 that Moody's describe as *rated as upper-medium grade and low credit risk* (long-term rating) and *best ability or high ability to repay short term debt* (short-term rating). Just five days later, Lehman Brothers files for Chapter 11 and Moody's downgrades the credit rating to B3 meaning that a company do not have any ability to pay short-term debt and long-term debt is high risk and speculative.

However, my "post financial crisis" -period starts already on 1st January 2009 that can be seen rather early but due to the lack of data this is the compromise I take in my Thesis.

Table 7. IPO returns: Pre- and Post-financial crisis.

	Dependent variable:			
	IPO return: %-change of closing price – issue price			
	Pre-2008	*Post-2008*	*Pre-2008*	*Post-2008*
	(1)	(2)	(3)	(4)
CREDIT	-0.135***	-0.057	-0.101*	0.037
	(0.040)	(0.093)	(0.058)	(0.102)
PROFITABLE			0.0004**	0.001
			(0.0002)	(0.005)
LOGSALES			-0.017***	-0.011
			(0.006)	(0.022)
LEVERAGE			-0.022*	0.015
			(0.012)	(0.108)
PPE/TOTAL ASSETS			-0.097*	-0.146
			(0.052)	(0.148)
ALTMANZ			-0.00000	0.001
			(0.00004)	(0.001)
Fixed effects?	Yes	Yes	Yes	Yes
Observations	3,820	453	1,384	83
R^2	0.121	0.007	0.173	0.221
Adjusted R^2	0.115	-0.013	0.154	0.074
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 7. Regression results for the subsamples (1980-2007 & 2009-2018) using OLS with yearly fixed effects. Standard errors are in brackets under coefficient estimates and statistical significance is reported with *, ** and *** to sign statistical significance at 10%, 5% and 1% levels respectively.

In Table 7 I have made regressions using now two subsamples from the original sample used in Table 5. When separating the data as described above, even after including control variables, pre-2008 sample seems to have statistically significant negative coefficient at the level of 10% that is in line with my *H2*. This states that having a credit rating before IPO reduces the information asymmetry between the company and investor and thus lowering the IPO underpricing. But the effect is only at the first subsample, before the end of 2007. The sample size decreases significantly for the second subsample (N=83) and in that sample the coefficient is not statistically significant. The regression of pre-2008 has also higher adjusted R^2 of 0.154 compared to post-2008 sample's 0.074. These findings now are in line with An & Chan (2008) who find statistically significant negative coefficient for their sample. Their sample included data from 1986 to 2004.

I will not reject my *H2* with the level of 10%.

Figure 3. Pre-IPO rated IPOs / IPOs.

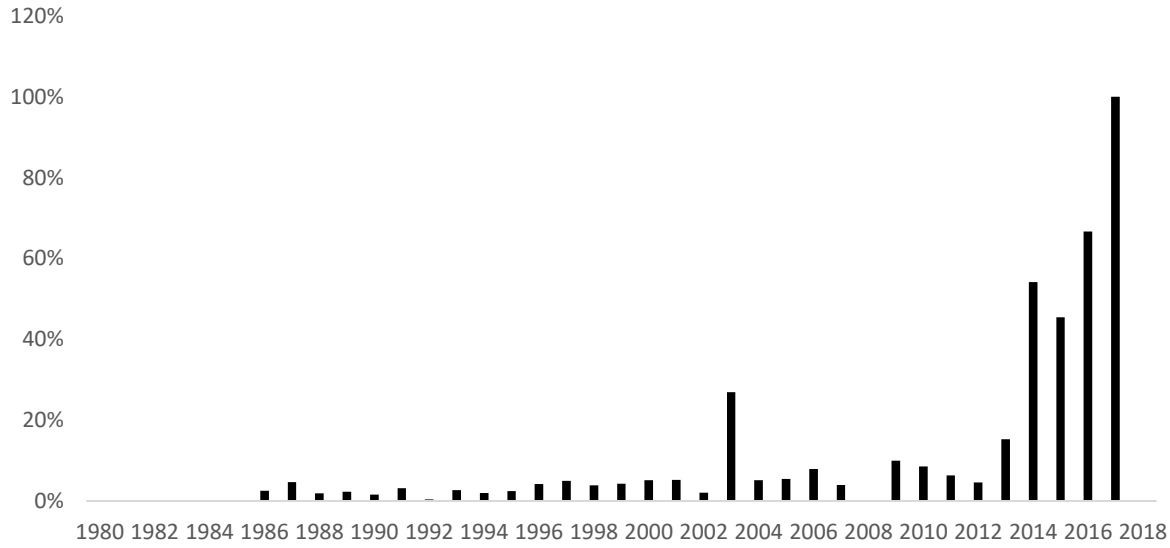

Figure 3. The portion of IPOs with pre-IPO credit rating in all IPOs.

Figure 3 above shows the portion in percentages of IPOs with pre-IPO credit rating year to year. It is somewhat surprising that the companies doing IPOs especially in the 2010' have been rated before the IPO. If we compare Figure 3 to my findings, companies are spending significant amount of money for a credit rating. In IPO vice that is not a profitable idea. The portion of pre-IPO credit ratings after the financial crisis might explain the results in Table 7: a large amount of listed companies have a credit rating and that might result statistically insignificant coefficient for the CREDIT variable.

4.2.3 Credit rating level

These findings in mind, next I will study if the pre-IPO credit rating level has an effect on the IPO underpricing. I will study this in two way: using the whole sample of IPOs with a pre-IPO credit rating and giving a dummy value from 1 to 22 according to the credit rating as follows (CRLEVEL):

Table 8. CRLEVEL dummy.

Rating	Dummy
D	*1*
C	*2*
CC	*3*
●●●	●●●
AA	*20*
AA+	*21*
AAA	*22*

Table 8. Illustrative table about credit rating level dummy.

I have also created a binary dummy variable resulting 1 if the credit rating level is in investment grade i.e. BBB- or higher and resulting 0 if the company is in high-yield grade (GRADE).

Figure 4. Pre-IPO ratings.

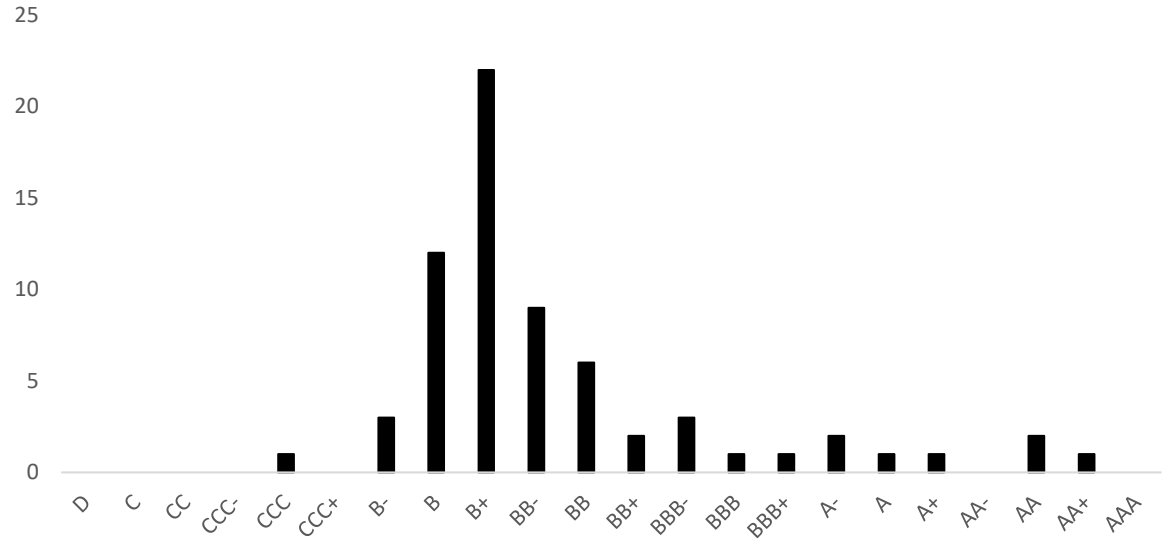

Figure 4. The deviation of different credit ratings within the pre-IPO credit rated companies.

Table 9. The effect of credit rating level on IPO underpricing.

	Dependent variable:			
	IPO return: %-change of closing price – issue price			
	(1)	(2)	(3)	(4)
CRLEVEL	-0.005		-0.036	
	(0.007)		(0.028)	
GRADE		0.045		0.161
		(0.065)		(0.223)
PROFITABLE			0.229	0.194
			(0.466)	(0.471)
LOGSALES			0.051	0.043
			(0.040)	(0.041)
LEVERAGE			-0.031	-0.013
			(0.167)	(0.168)
PPE/TOTAL ASSETS			-0.156	-0.147
			(0.243)	(0.247)
ALTMANZ			0.009	0.005
			(0.009)	(0.008)
Fixed effects?	Yes	Yes	Yes	Yes
Observations	206	206	76	76
R^2	0.111	0.111	0.391	0.376
Adjusted R^2	-0.047	-0.047	-0.015	-0.039
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 9. Regression results for the whole sample using OLS with yearly fixed effects. Standard errors are in brackets under coefficient estimates and statistical significance is reported with *, ** and *** to sign statistical significance at 10%, 5% and 1% levels respectively.

CRLEVEL is the dummy variable described in Table 8 and GRADE is binary dummy variable for splitting the grades of rating to investment grade and high-yield grade. Since neither the CRLEVEL nor the GRADE variable receive statistically significant coefficient, these findings are in line with *H1* and the current literature (see. An & Chan, 2008). The level of credit rating does not affect IPO underpricing.

4.2.4 Robustness checks using subsamples by decade

Table 10. IPO returns of subsamples by decade.

	Dependent variable:							
	IPO return: %-change of closing price – issue price							
	1980-1990		*1991-2000*		*2001-2010*		*2010-2018*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CREDIT	-0.034	-0.037	-0.187***	-0.116	-0.060	-0.105**	-0.033	0.054
	(0.079)	(0.100)	(0.055)	(0.089)	(0.073)	(0.045)	(0.048)	(0.159)
PROFITABLE		0.002		0.001*		0.0001		0.001
		(0.002)		(0.0003)		(0.0002)		(0.008)
LOGSALES		-0.023**		-0.024***		0.014*		-0.019
		(0.010)		(0.008)		(0.007)		(0.038)
LEVERAGE		-0.004		-0.015		-0.063*		0.025
		(0.051)		(0.014)		(0.038)		(0.238)
PPE/TOTAL ASSETS		0.023		-0.151**		0.038		-0.293
		(0.081)		(0.072)		(0.056)		(0.275)
ALTMANZ		-0.0002		0.001***		-0.00003		0.001
		(0.001)		(0.0002)		(0.00002)		(0.001)
Fixed effects?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	401	231	2,785	962	776	232	331	49
R^2	0.019	0.056	0.116	0.182	0.007	0.120	0.023	0.255
Adjusted R^2	-0.004	-0.005	0.113	0.169	-0.006	0.059	0.001	0.033
Note:								*p<0.1; **p<0.05; ***p<0.01

Table 10. Regression results for the subsamples using OLS with yearly fixed effects. Standard errors are in brackets under coefficient estimates and statistical significance is reported with *, ** and *** to sign statistical significance at 10%, 5% and 1% levels respectively.

Table 10 shows the regressions within subsamples. This table tells us in more detail the story behind Tables 5 and 7. AS Loughran and Ritter (2004) argues, underpricing in general varies across market cycles: The IPO underpricing heats up when the market heats up (e.g. before financial crisis). This enlightens the differences between my and An and Chan's (2008) results since they studied the period between 1986 and 2004.

4.2.5 Returns and volatilities

In this section I will calculate the returns and volatilities for different periods. I will compare then the results between the companies having pre-IPO credit rating and companies without a pre-IPO credit rating. I will seek answers for *H3*.

> *H3: Companies with a pre-IPO credit rating have lower volatilities after the IPO compared to other companies. This means less uncertainty in the returns and thus lower expected returns.*

In Table 12 I have calculated the mean returns and mean volatilities for 30, 60, 120 and 365 days after IPO. An & Chan (2008) studied also the differences in volatilities in their papers and excluded the first trading week to control extreme volatilities but I will also include the first week of trading: I argue that the early stage credit rating keeps volatilities low after the IPO and thus will result in less volatility but this has no effect on returns.

First, I will study returns within the two group by doing regressions using Fama-French five-factor model added with momentum factor. Then I will compare pure means of returns and volatilities and calculate Sharpe ratios.

In the Table 11 below, are the results for simple OLS regression of the first month and first year returns after IPO with the following formula (please see Section 6 Methodology for detailed description of the formula)

$$R_{i,t} = \gamma_{i,t}CRD + R_f + \beta_{R_M}(R_m - R_f) + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{RMW}RMW + \beta_{CMA}CMA + \beta_{MOM}MOM + \varepsilon_{i,t}$$

As we can see from the regression results the returns are mostly explained by the market returns (Mkt-RF) and also other Fama-French factors. The long-term returns seem not to have a positive constant (except the 60-day period) so the underpricing anomaly seems to flatten away in longer period returns and holding a stock after the IPO will not generate excess returns. The IPO literature argues also in favor of this. For example, Gajewski and Gresse (2006) argues that long-term results differ from measurement model to other, but IPOs does not generate excess returns and might even underperform against the market.

Table 11. 30-, 60-, 120-, 365-day excess returns.

	Dependent variable:			
	R_{30}	R_{60}	R_{120}	R_{365}
	(1)	(2)	(3)	(4)
CREDIT	-0.016	-0.039	-0.021	-0.002
	(0.040)	(0.052)	(0.058)	(0.118)
$R_m - R_f$	0.713***	1.249***	1.260***	1.292***
	(0.263)	(0.226)	(0.201)	(0.196)
SMB	0.902***	0.588*	1.431***	0.340
	(0.335)	(0.330)	(0.247)	(0.376)
HML	-0.919**	-1.149***	-0.595**	0.154
	(0.435)	(0.435)	(0.303)	(0.251)
RMW	-0.647	-1.300**	-0.038	-1.568***
	(0.446)	(0.535)	(0.281)	(0.417)
CMA	-0.379	-1.022	-0.208	-1.399***
	(0.660)	(0.625)	(0.433)	(0.464)
MOM	0.500**	0.027	0.923***	-0.708***
	(0.238)	(0.290)	(0.180)	(0.205)
Constant	0.028	0.054**	-0.004	0.029
	(0.020)	(0.025)	(0.029)	(0.071)
Observations	808	786	1,544	1,192
R^2	0.127	0.161	0.164	0.088
Adjusted R^2	0.118	0.153	0.159	0.082
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 11. Regression results for returns after IPO. The periods are 30, 60, 120 and 365 calendar days after the IPO. Standard errors are in brackets under coefficient estimates and statistical significance is reported with *, ** and *** to sign statistical significance at 10%, 5% and 1% levels respectively.

In Table 12 I have calculated the mean returns and mean volatilities for 30, 60, 120 and 365 days after IPO.

Table 12. Mean of returns & volatilities.

	Pre-IPO credit rating	*No pre-IPO credit rating*
Volatility (30)	2.49 %	3.79 %
Volatility (60)	2.59 %	3.64 %
Volatility (120)	3.04 %	4.10 %
Volatility (365)	3.53 %	4.48 %
Return (30)	3.88 %	3.92 %
Return (60)	1.01 %	6.43 %
Return (120)	3.18 %	7.84 %
Return (365)	5.85 %	8.39 %
Sharpe ratio (30)	1.557	1.035
Sharpe ratio (60)	0.391	1.766
Sharpe ratio (120)	1.045	1.912
Sharpe ratio (365)	1.658	1.872

Table 12. The average volatilities, excess returns and Sharpe ratios for 30, 60, 120 and 365 days after IPO

The volatilities behave as expected even in the long-term: the companies having a pre-IPO credit rating tends to have less volatility after the IPO: This is also in line with the current literature by An & Chan (2008). The returns are also lower as expected among the pre-IPO credit rated firms. This means no rejection for *H3*.

Using these figures, I am available to calculate the Sharpe ratios for different periods using the Sharpe ratio formula by Sharpe (1966).

$$Sharpe\ ratio = \frac{R_p - R_f}{\sigma_p}$$

, where $R_p - R_f$ is the excess return of a portfolio over the risk-free ratio and σ_p is the standard deviation of the portfolio. The higher the ratio the more the portfolio generates returns against its volatility.

5 CONCLUSION

In this Thesis I have studied IPOs with a credit rating focus. Especially I have been keen in researching IPO underpricing between two groups during 1980 and 2018: companies having a credit rating before going public and companies going public without a credit rating.

I started my study with a relevant literature review of current findings within the subject. For now, the literature has basically one complete paper about the topic (An and Chan, 2008) and I am heavily relating to that paper in my Thesis. The key-questions I want to cover in this study are

1. Are pre-IPO rated companies underpriced less in IPOs?
2. Has this phenomenon changed over time, especially after the financial crisis?
3. Can we find something interesting when comparing the returns and volatilities after the IPO over certain time?

To explore these questions, I established three hypotheses.

Before getting into my research questions I wanted to see and create understanding on having a pre-IPO credit rating. I did this using probit model that tested, what factors affected on having credit rating. I find that amount of sales, leverage and tangible assets are the largest positive factors for this. These findings were in line with the An and Chan's findings and are also intuitive: the larger the company, the more visibility the company usually has and the more resources it might have to acquire a credit rating; the more leveraged the company, the more it is involved in loans and thus a credit rating would be a good / required emblem to have; the more tangible balance sheet the company has, the more it has PPE to pledged and thus it opens more possibilities to be more leveraged. I also run a probit model to see are the factors same on having a pre-IPO credit rating. The model shows that the companies having a pre-IPO credit rating are actually profitable unlike a company having a credit rating in general. These companies are also more leveraged.

In the Section 7.2. IPO underpricing I studied first the whole sample using OLS. Then I compared the pre-crisis and post-crisis periods with two subsamples. I was able to find that IPO underpricing among the companies having pre-IPO credit rating has changed between 2008: before 2008 the companies with a pre-IPO credit rating were statistical significantly less underpriced in IPOs than the companies without a credit rating (at 10% level). However, statistical significance disappears with the subsample after the 2008. I argue that this is due to

the loss of credit rating agencies' credibility after the happenings of 2008 in which they played a major role and the market learned not to trust their projections (see Section 7.2.2. Financial Crisis). Here I see also potential for future research: the companies having a pre-IPO credit rating somewhat drops after 2008 but this study could be performed when there is more data available: In my study one can argue if it was too early to perform this study.

After the financial crisis review I study if the pre-IPO credit rating level has any effect on the IPO underpricing with two tests: I pointed a dummy for all different credit ratings from 1 to 22 ($D = 1, \dots, AAA = 22$). In addition, I divided the sample simply in two groups: investment grade group (1) and high-yield grade (0). As the current literature, my findings are in line with it and it seems that the level of pre-IPO credit rating does not have a statistically significant effect on IPO underpricing.

After the review of credit rating levels, I did some robustness checks by splitting the data in even more pieces and performed regressions by decade. This enlightens the reasons behind my results and helps to time the findings. As Loughran and Ritter (2004) argues there happens more IPOs and the IPO underpricing is larger during hot market cycles. The period of 2001-2010 had a statistically significant negative coefficient with control variables that makes sense as being a "hot" market cycle. Most of the IPOs occurred during 1991 and 2000 but this period had no statistically significant underpricing effect with the pre-IPO credit rating factor that was a slight surprise.

The last Section of results studies the returns and volatilities. I start this section by regressing first month and first year returns after IPO using Fama-French five factor model (Fama and French, 1993) added with momentum factor (Carhart, 1997) and the CREDIT dummy (1, if company does have a pre-IPO credit rating and 0 if a company does not have a pre-IPO credit rating). These regressions results gave no surprises and the pre-IPO credit rating seems neither to boost nor decrease the stock performance after the IPO in a first month's or first year's period after the IPO.

5.1 Future research

As a summary I have been able to answer my initial research questions and have contributed the current literature with new findings that the data has been able to show after the financial crisis. However, there are still great possibilities around this subject. For future research, I would try to divide investors in different groups (see for example Rantapuska 2008). In

addition, when there is more data available and the post-2008 sample would be larger I would run these tests again. Also, using different control variables are always a good idea to study the same issue. I chose US IPOs as my sample since the European sample of pre-IPO rated firms were relatively small in 2018, but this study could be also done with European firms.

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7 APPENDIX

If you are interested on the data or the ways I have handled it, please be in touch by e-mail: roope_parmasuo@hotmail.com